

UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

PATENT NO. : 6,888,243 B2  
APPLICATION NO. : 09/964462  
DATED : May 3, 2005  
INVENTOR(S) : Yasuo Yamaguchi

Page 1 of 18

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

The title page should be deleted to appear as per attached title page.

Signed and Sealed this

Eighth Day of January, 2008

A handwritten signature in black ink, reading "Jon W. Dudas". The signature is stylized, with a large, looped initial "J" and a distinct "D" at the end.

JON W. DUDAS  
*Director of the United States Patent and Trademark Office*

(12) **United States Patent**  
**Yamaguchi**

(10) Patent No.: **US 6,888,243 B2**  
(45) Date of Patent: **May 3, 2005**

(54) **SEMICONDUCTOR DEVICE**

(75) Inventor: **Yasuo Yamaguchi, Tokyo (JP)**

(73) Assignee: **Renesas Technology Corp., Tokyo (JP)**

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 351 days.

(21) Appl. No.: **09/964,462**

(22) Filed: **Sep. 28, 2001**

(65) Prior Publication Data

US 2002/0105079 A1 Aug. 8, 2002

(30) Foreign Application Priority Data

Feb. 6, 2001 (JP) ..... 2001-029807

(51) Int. Cl.<sup>7</sup> ..... **H01L 23/48**

(52) U.S. Cl. .... **257/748; 257/758; 257/774; 257/471**

(58) Field of Search ..... **257/748, 758, 257/280, 613, 471, 774**

(56) References Cited

**U.S. PATENT DOCUMENTS**

4,779,127 A \* 10/1988 Honjo ..... 357/41  
5,444,015 A \* 8/1995 Aitken et al. .... 437/182  
5,457,344 A \* 10/1995 Bartelink ..... 257/737  
5,900,668 A \* 5/1999 Wollanen ..... 257/522  
5,937,321 A \* 8/1999 Beck et al. .... 438/622  
5,994,777 A \* 11/1999 Farrar ..... 257/758  
6,034,433 A \* 3/2000 Beatty ..... 257/758  
6,078,106 A \* 6/2000 Kawata ..... 257/758  
6,100,589 A \* 8/2000 Tamaka ..... 257/758

6,124,604 A \* 9/2000 Koyama et al. .... 257/72  
6,130,449 A \* 10/2000 Matsuoaka ..... 257/296  
6,222,270 B1 \* 4/2001 Lee ..... 257/758  
6,246,118 B1 \* 6/2001 Buynoski ..... 257/758  
6,297,563 B1 \* 10/2001 Yamaha ..... 257/781  
6,307,252 B1 \* 10/2001 Knoodl, Jr. .... 257/659  
6,337,517 B1 \* 1/2002 Ohta et al. .... 257/758  
6,404,001 B2 \* 6/2002 Koo et al. .... 257/296

**FOREIGN PATENT DOCUMENTS**

JP 3-248458 11/1991  
JP 5-347412 12/1993  
JP 10-270704 10/1998  
JP 11-135799 5/1999  
JP 11-238734 8/1999  
JP 11-354807 12/1999

\* cited by examiner

Primary Examiner—David L. Tibbott

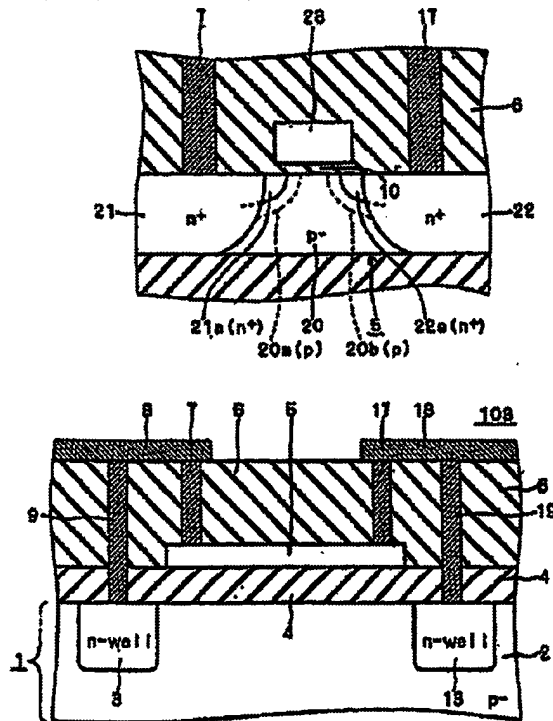
Assistant Examiner—Lourdes Cruz

(74) Attorney, Agent, or Firm—Oblon, Spivak, McClelland, Maier & Neustadt, P.C.

(57) **ABSTRACT**

To improve the radiation property without inhibiting miniaturization of the device, heat generated at a heat generating layer (5) is radiated to a substrate (1) via plugs (7, 17), wiring layers (8, 18), and plugs (9, 19). A cross sectional along the principal plane of the substrate (1) of the plugs (7, 9, 17, 19) is set to be a rectangle, and the long sides of the rectangle are parallel to the direction perpendicular to the direction connecting one end and the other end of the heat generating layer (5). Between the plugs (9, 19) and the semiconductor layer (2) is interposed n-type semiconductor layers (3, 13).

20 Claims, 12 Drawing Sheets



UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

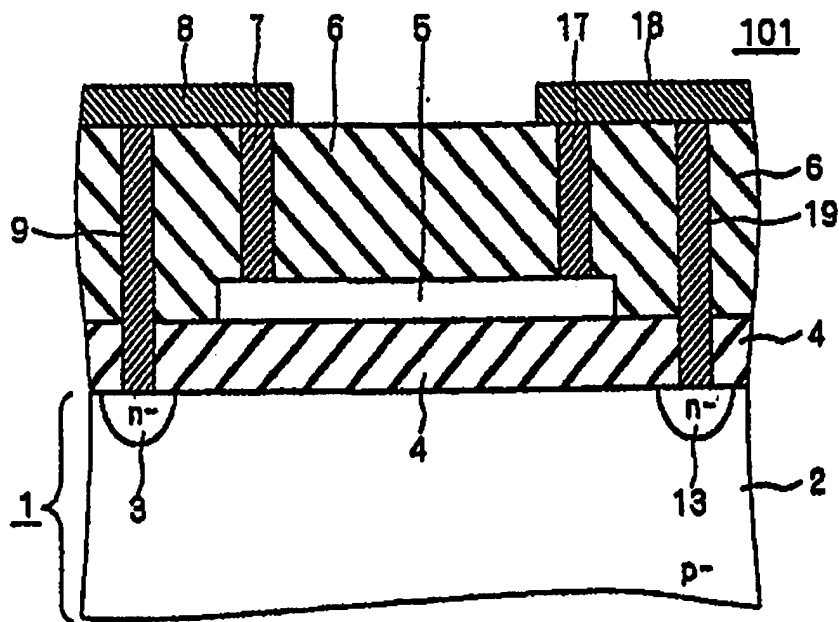
PATENT NO. : 6,888,243 B2  
APPLICATION NO. : 09/964462  
DATED : May 3, 2005  
INVENTOR(S) : Yasuo Yamaguchi

Page 3 of 18

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

**In the drawings, please replace figure 1 with the following figure 1:**

*F / G. 1*



UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

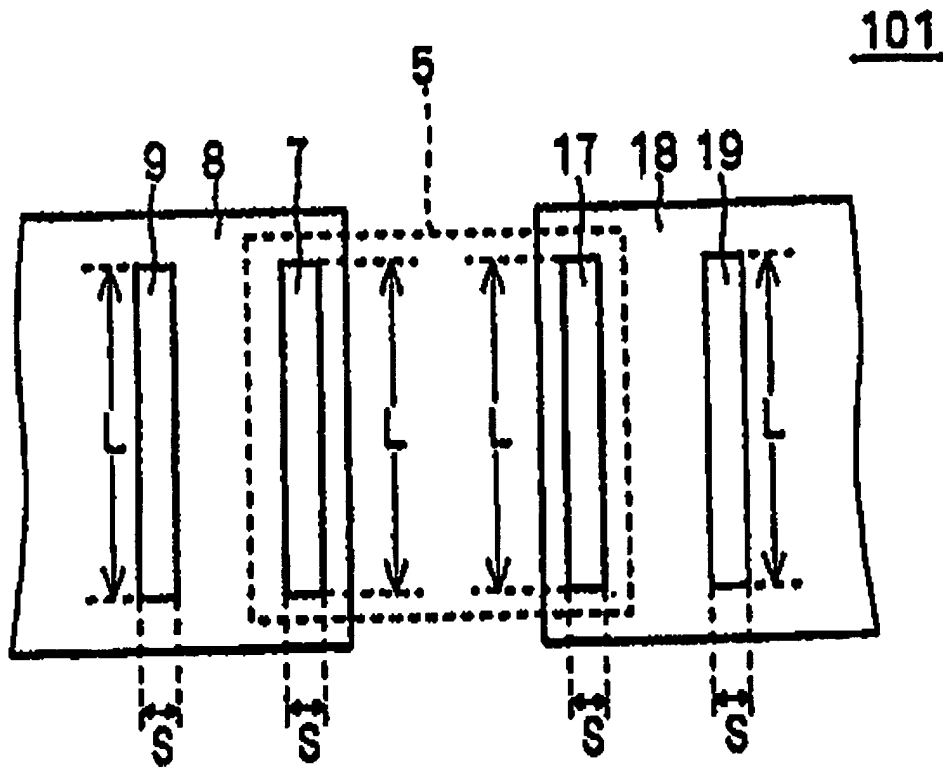
PATENT NO. : 6,888,243 B2  
APPLICATION NO. : 09/964462  
DATED : May 3, 2005  
INVENTOR(S) : Yasuo Yamaguchi

Page 4 of 18

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the drawings, please replace figure 2 with the following figure 2:

**FIG. 2**



UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

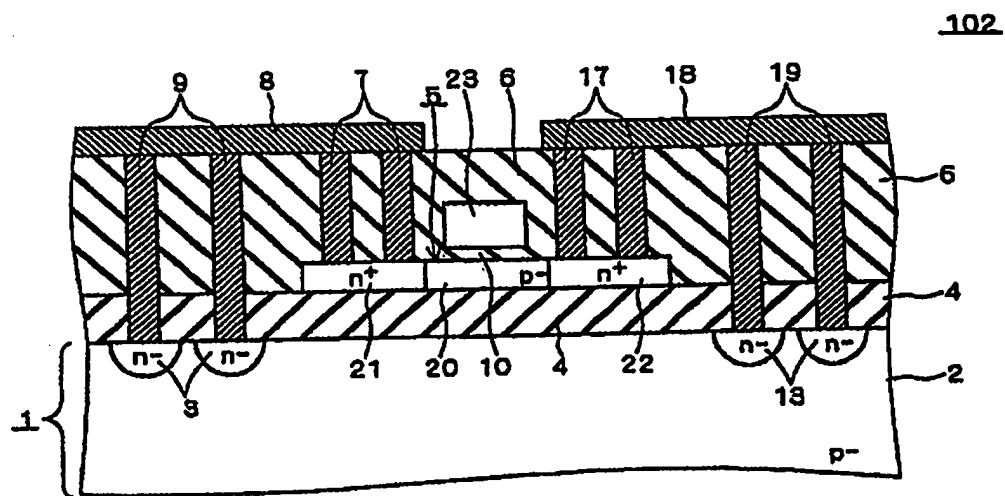
PATENT NO. : 6,888,243 B2  
APPLICATION NO. : 09/964462  
DATED : May 3, 2005  
INVENTOR(S) : Yasuo Yamaguchi

Page 5 of 18

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the drawings, please replace figure 3 with the following figure 3:

**FIG. 3**



UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

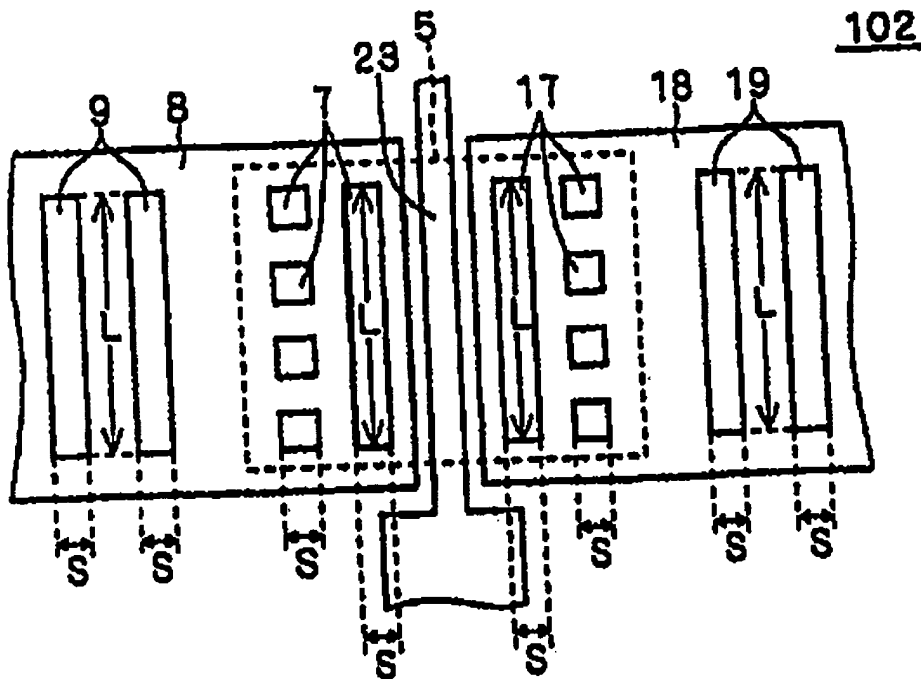
PATENT NO. : 6,888,243 B2  
APPLICATION NO. : 09/964462  
DATED : May 3, 2005  
INVENTOR(S) : Yasuo Yamaguchi

Page 6 of 18

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the drawings, please replace figure 4 with the following figure 4:

**FIG. 4**



UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

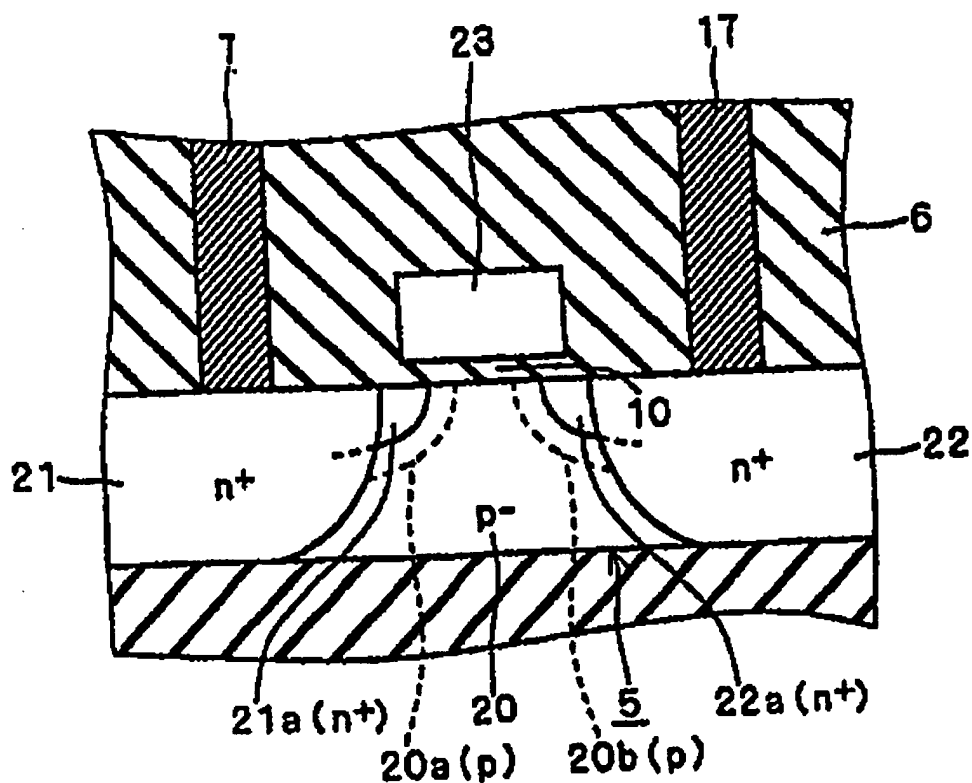
PATENT NO. : 6,888,243 B2  
APPLICATION NO. : 09/964462  
DATED : May 3, 2005  
INVENTOR(S) : Yasuo Yamaguchi

Page 7 of 18

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the drawings, please replace figure 5 with the following figure 5:

**FIG. 5**



## CERTIFICATE OF CORRECTION

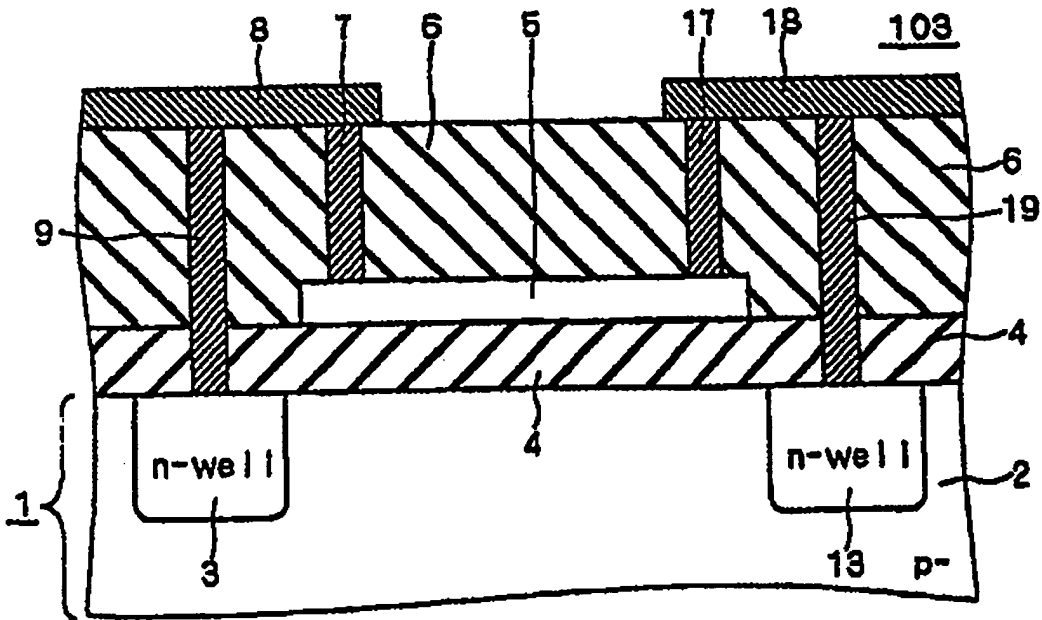
INVENTOR(S) : Yasuo Yamaguchi

Page 8 of 18

hereby corrected as shown below:

In the drawings, please replace figure 6 with the following figure 6:

***F / G. 6***





UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

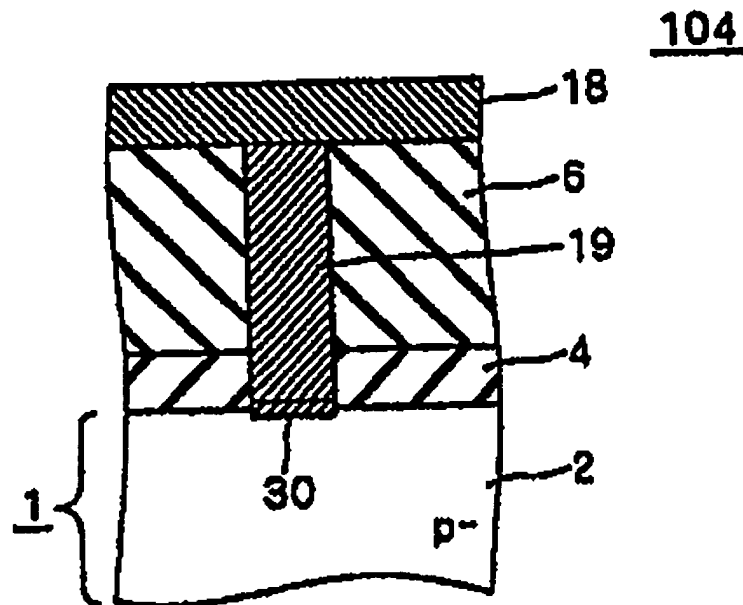
PATENT NO. : 6,888,243 B2  
APPLICATION NO. : 09/964462  
DATED : May 3, 2005  
INVENTOR(S) : Yasuo Yamaguchi

Page 9 of 18

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the drawings, please replace figure 7 with the following figure 7:

**FIG. 7**



UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

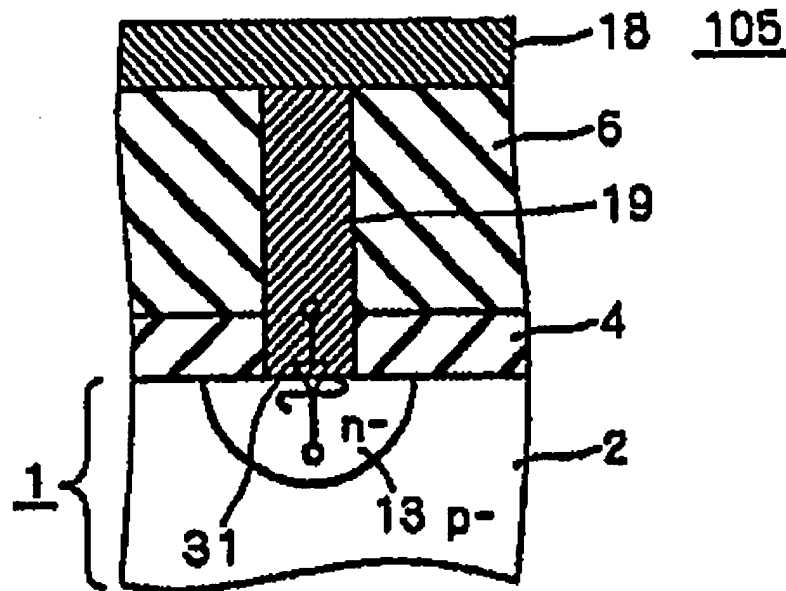
PATENT NO. : 6,888,243 B2  
APPLICATION NO. : 09/964462  
DATED : May 3, 2005  
INVENTOR(S) : Yasuo Yamaguchi

Page 10 of 18

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the drawings, please replace figure 8 with the following figure 8:

**FIG. 8**



UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

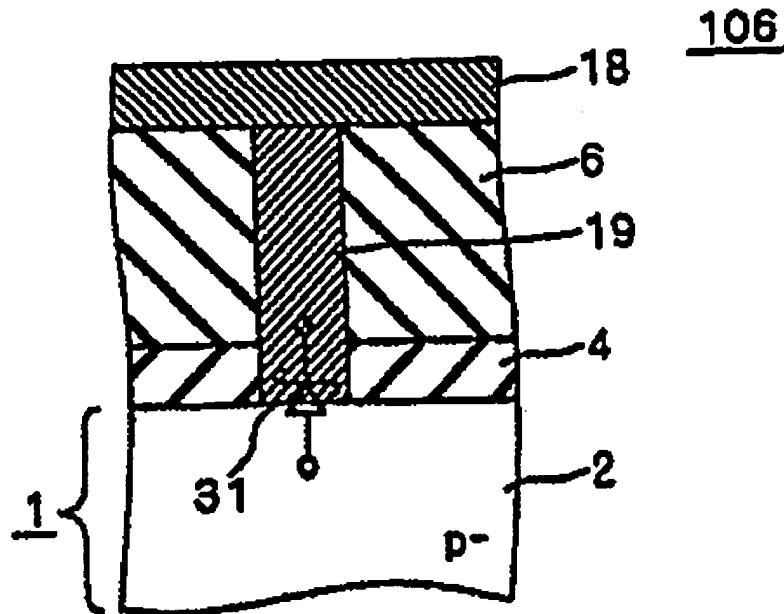
PATENT NO. : 6,888,243 B2  
APPLICATION NO. : 09/964462  
DATED : May 3, 2005  
INVENTOR(S) : Yasuo Yamaguchi

Page 11 of 18

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the drawings, please replace figure 9 with the following figure 9:

**FIG. 9**



UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

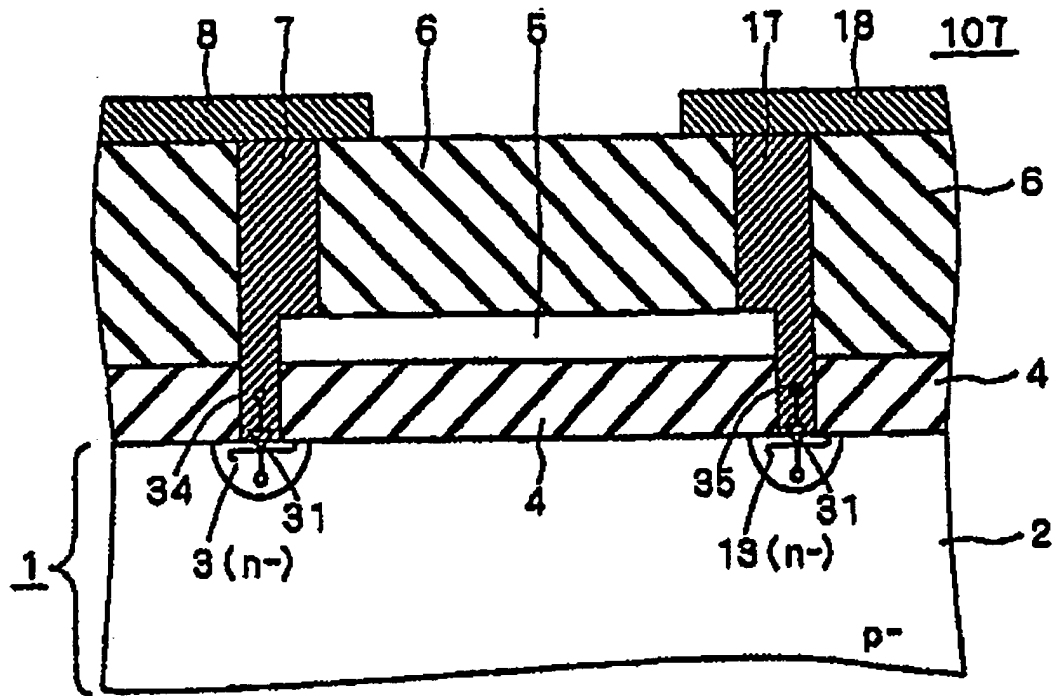
PATENT NO. : 6,888,243 B2  
APPLICATION NO. : 09/964462  
DATED : May 3, 2005  
INVENTOR(S) : Yasuo Yamaguchi

Page 12 of 18

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the drawings, please replace figure 10 with the following figure 10:

**FIG. 10**



UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

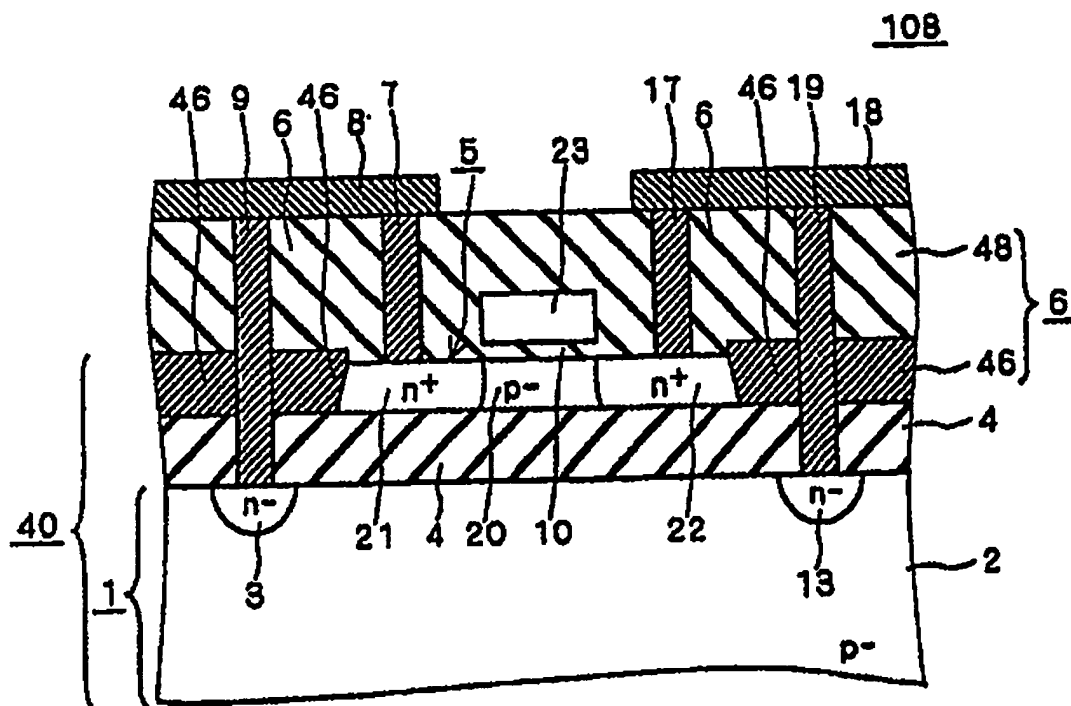
PATENT NO. : 6,888,243 B2  
APPLICATION NO. : 09/964462  
DATED : May 3, 2005  
INVENTOR(S) : Yasuo Yamaguchi

Page 13 of 18

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the drawings, please replace figure 11 with the following figure 11:

F/G. 11



UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

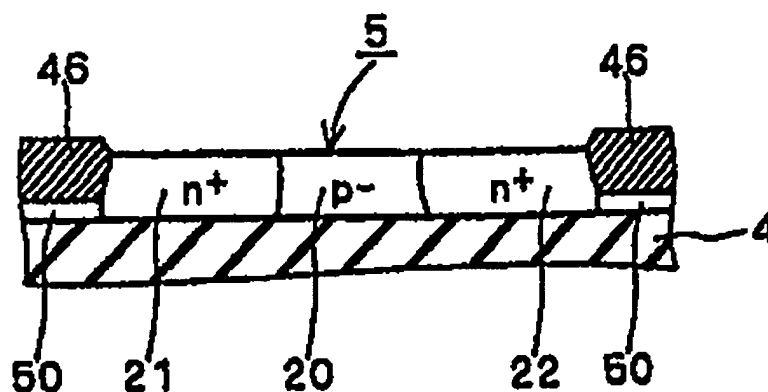
PATENT NO. : 6,888,243 B2  
APPLICATION NO. : 09/964462  
DATED : May 3, 2005  
INVENTOR(S) : Yasuo Yamaguchi

Page 14 of 18

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the drawings, please replace figure 12 with the following figure 12:

*FIG. 12*



UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

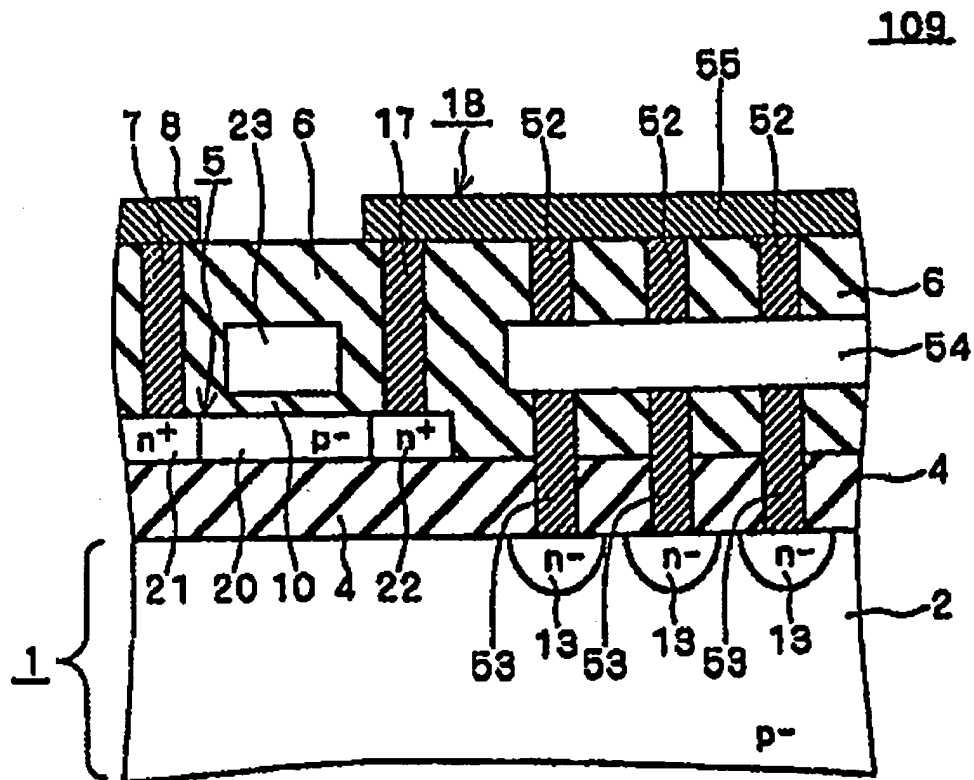
PATENT NO. : 6,888,243 B2  
APPLICATION NO. : 09/964462  
DATED : May 3, 2005  
INVENTOR(S) : Yasuo Yamaguchi

Page 15 of 18

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the drawings, please replace figure 13 with the following figure 13:

**FIG. 13**



UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

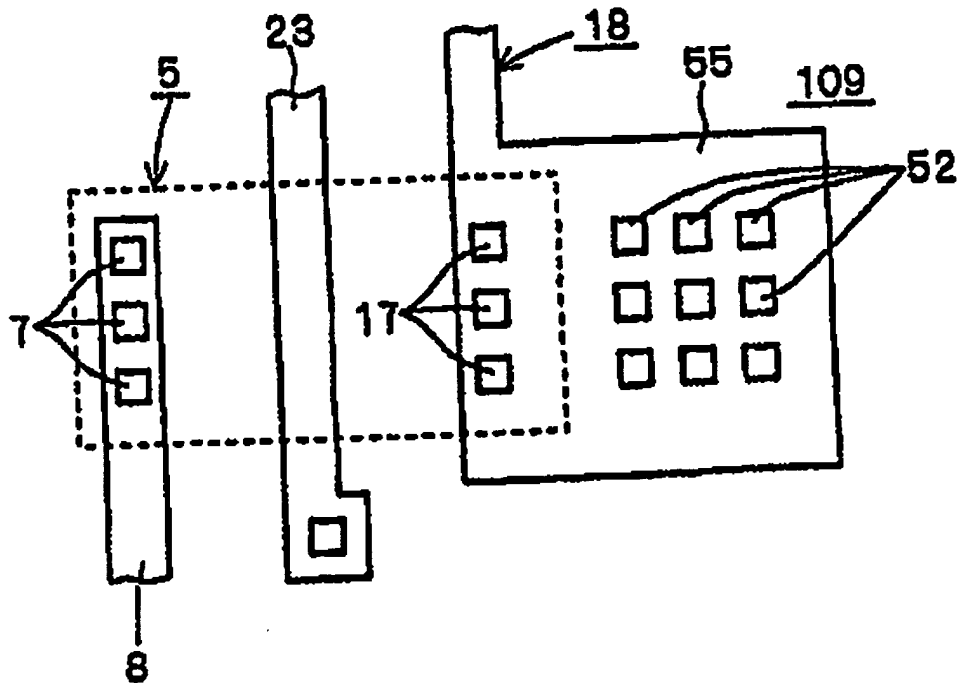
PATENT NO. : 6,888,243 B2  
APPLICATION NO. : 09/964462  
DATED : May 3, 2005  
INVENTOR(S) : Yasuo Yamaguchi

Page 16 of 18

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the drawings, please replace figure 14 with the following figure 14:

**FIG. 14**





UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

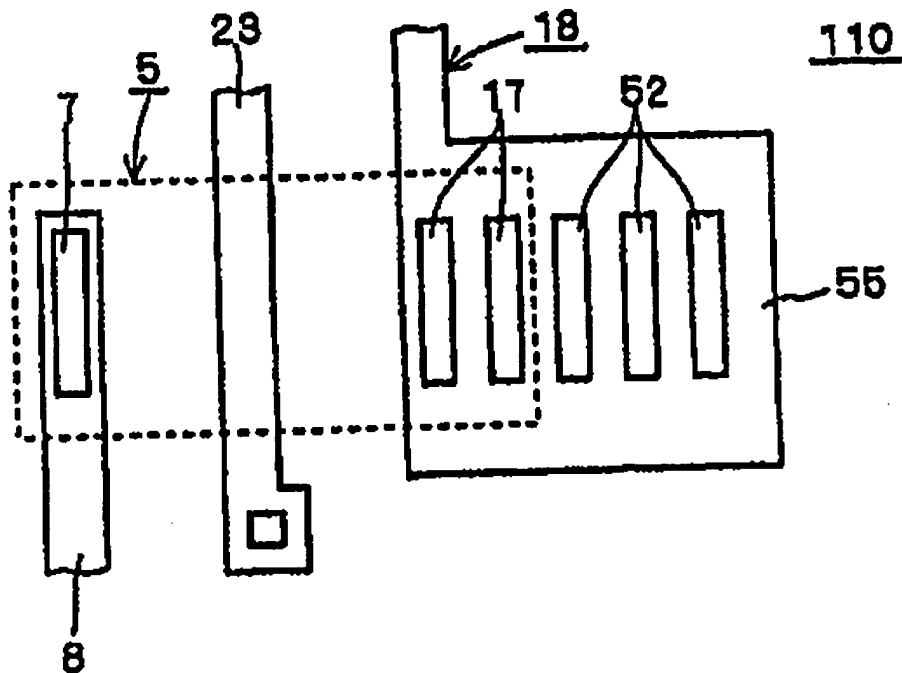
PATENT NO. : 6,888,243 B2  
APPLICATION NO. : 09/964462  
DATED : May 3, 2005  
INVENTOR(S) : Yasuo Yamaguchi

Page 17 of 18

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In the drawings, please replace figure 15 with the following figure 15:

**FIG. 15**



UNITED STATES PATENT AND TRADEMARK OFFICE  
**CERTIFICATE OF CORRECTION**

PATENT NO. : 6,888,243 B2  
APPLICATION NO. : 09/964462  
DATED : May 3, 2005  
INVENTOR(S) : Yasuo Yamaguchi

Page 18 of 18

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

**In the drawings, please replace figure 16 with the following figure 16:**

FIG. 16

